

Time machine and the second law of thermodynamics.

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Time travel is only possible in science fiction stories. If I'm wrong, then show me a time traveler (from the future, or from the past). To paraphrase Fermi [1], we can say: if time travel is possible, then where are the travelers? We should see a lot of time travelers around us now, but they are not. Just like there are no aliens. Fermi is right: there is nothing (no aliens, no time travel). Time travel is contrary to the fundamental laws of physics. For example, the second law of thermodynamics [2]. But that's not all.

If time travel is possible, then time is a vector (more precisely, the space-time continuum is a vector). But this is not the case. In my opinion, time is correct to consider as a scalar. However, in physical formulas, time is exactly that. The future and the past do not really exist. And the reason for this is that time is a scalar. Like a temperature field: there is a temperature gradient in the medium, but the temperature is a scalar, this is why it is impossible to get into the "temperature past", according to the second law of thermodynamics.

Also time dilation near massive bodies is analogous to a higher temperature (or lower) in the medium. Therefore, there can be no time travel. Temperature is just showing a scalar field. This is a good analogy if time is a scalar. No more.

And our sense of the passage of time is a consequence of the fact that we can feel the "gradient of time". We are a kind of device that registers a gradient.

The second law of thermodynamics forbids time travel. Let's show it.

Let's say that you can travel in time (to the past, or to the future). Moreover, it does not matter for us whether it is possible to return back (in due time), or travel is possible only in one direction. Let there be a time machine that will send us to the past or the future. Then, we can transfer all matter from "our time" to the past or the future. Let us imagine such an "angel of time" who transports matter to other times.

If travel "back" in time is possible, then all matter can be "transported" by one time machine, but there will be many such transports. If travel "back" is impossible, then you can make many such machines, and again transfer all matter to the past or the future (on all machines). But, if we transfer all matter into the past or into the future, then "our time", "our reality" will disappear, since there is no Universe without matter. And this is already strict physics. Therefore, the time machine is essentially the destroyer of the Universe. And since the Universe exists, the time machine does

not exist. Conversely, if a time machine existed, then the Universe would not exist.

The second law of thermodynamics prohibits time travel, since it is violated during the transfer of all matter of "our time" into the past. This is obvious: after the "big transfer" of matter into the past (when there is still matter in "our time"), in "our time" the entropy will be much less than in the past (any past). And according to the second law of thermodynamics, this is impossible. Likewise with traveling to the future. If one can travel to the future, then we can also "transfer" almost all matter to the future. This means that in "our time" there will be a sharp decrease in entropy in comparison with the past (any). But, this is also impossible according to the second law of thermodynamics.

In addition, time travel implies that there is a certain "frame (slice) of time" (frozen time), and we can travel from it to "another time". But this is not the case. We subconsciously transfer our human sense of time to the Universe. There is nothing like this in the Universe, since the Universe does not have any "time frames". And the reason for this is simple: there is no separate time, but there is a space-time continuum, and there is an interval. And if we consider the interval [3], then the flow of time at a particular point depends on the coordinates of this point. Therefore, there can be no "time frame" by definition. By the way, this is confirmed by our Universe: we remember the Hubble-Lemaître law [4].

1. Fermi paradox. Wikipedia. https://en.wikipedia.org/wiki/Fermi_paradox
2. Second law of thermodynamics. Wikipedia.
https://en.wikipedia.org/wiki/Second_law_of_thermodynamics
3. Spacetime. Wikipedia. https://en.wikipedia.org/wiki/Spacetime#Spacetime_interval
4. Bezverkhniy V. D., Bezverkhniy V. V. The speed of light, the Big Bang and the expansion of the Universe. ResearchGate (2020). DOI: 10.13140/RG.2.2.34775.50087.
https://www.academia.edu/44005575/The_speed_of_light_the_Big_Bang_and_the_expansion_of_the_Universe
5. Quora: Is a time machine really possible? <https://qr.ae/pN45qn>